

What is claimed is:

1. A method for extracting and recovering a metal from an aqueous solution containing the metal comprising of the steps of: (1) contacting an
5 organic phase comprised of a water insoluble and water immiscible solvent solution of an extraction reagent formulation substantially free of metal values with a first aqueous metal bearing solution to extract at least a portion of the metal into the organic phase to form a metal depleted aqueous raffinate solution and a first partially loaded organic phase wherein the first
10 aqueous metal bearing solution is the raffinate from step (3); (2) contacting the first partially loaded organic phase with a second aqueous metal bearing solution to form a metal depleted aqueous raffinate solution and a second partially loaded organic phase having a metal content greater than the first partially loaded organic phase; (3) contacting the second partially loaded
15 organic phase with a third aqueous metal bearing solution to form a partially metal depleted aqueous and a third partially loaded organic phase.
2. The method of claim 1 wherein the extraction reagent is a mixture comprised of an aldoxime and a ketoxime.
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3. The method of claim 2 wherein the mixture is further comprised of an equilibrium modifier.
4. The method of claim 1 wherein the extraction reagent is an aldoxime.

5. The method of claim 1 wherein the extraction reagent is a ketoxime.
6. The method of claim 1 wherein the metal is zinc.
- 5 7. The method of claim 1 wherein the metal is uranium.
8. The method of claim 1 wherein the metal is cobalt.
9. The method of claim 1 wherein the metal is molybdenum.
- 10 10. The method of claim 1 wherein the metal is nickel.
11. The method of claim 1 wherein the metal is copper.
- 15 12. The method of claim 6 wherein the extraction reagent is di-2-ethylhexylphosphoric acid.
13. The method of claim 7 wherein the extraction reagent is a tertiary fatty amine.
- 20 14. The method of claim 8 wherein the extraction reagent is a tertiary fatty amine.
15. The method of claim 9 wherein the extraction reagent is a tertiary fatty amine.
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16. The method of claim 10 wherein the extraction reagent is an organo phosphonic acid or phosphinic acid or a carboxylic acid.

17. The method of claim 11 wherein the extraction reagent is an
5 aldoxime, a ketoxime or a combination thereof.

18. A method for extracting and recovering copper from an aqueous solution containing the copper comprising of the steps of: (1) contacting an organic phase comprised of a water insoluble and water immiscible solvent
10 solution of an extraction reagent formulation substantially free of copper values with a first aqueous metal bearing solution to extract at least a portion of the copper into the organic phase to form a copper depleted aqueous raffinate solution and a first partially loaded organic phase wherein the first aqueous copper bearing solution is the raffinate from step (3); (2) contacting
15 the first partially loaded organic phase with a second aqueous copper bearing solution to form a copper depleted aqueous raffinate solution and a second partially loaded organic phase having a copper content greater than the first partially loaded organic phase; (3) contacting the second partially loaded organic phase with a third aqueous copper bearing solution to form a
20 partially copper depleted aqueous and a third partially loaded organic phase.

19. The method of claim 18 wherein the extraction reagent is an aldoxime, a ketoxime or a combination thereof.

20. The method of claim 19 wherein the mixture is further comprised of an equilibrium modifier.

21. The method of claim 18 further comprising the step of recovering the copper by contacting the third loaded organic phase with an aqueous acid solution wherein the copper is transferred to the aqueous acid solution to form a strip aqueous phase.

22. The method of claim 21 further comprising the step of recovering the copper from the strip aqueous phase by electrowinning.

23. A method for extracting and recovering a metal from an aqueous solution containing the metal comprising of the steps of: (1) contacting an organic phase comprised of a water insoluble and water immiscible solvent solution of an extraction reagent formulation substantially free of metal values with a first aqueous metal bearing solution to extract at least a portion of the metal into the organic phase to form a metal depleted aqueous raffinate solution and a first partially loaded organic phase wherein the first aqueous metal bearing solution is the raffinate from step (3); (2) contacting the first partially loaded organic phase with a second aqueous metal bearing solution to form a metal depleted aqueous raffinate solution and a second partially loaded organic phase having a metal content greater than the first partially loaded organic phase; (3) contacting the second partially loaded organic phase with a third aqueous metal bearing solution to form a metal depleted aqueous raffinate solution and a third partially loaded organic

phase having a metal content greater than the second partially loaded organic phase; (4) contacting the third partially loaded organic phase with a fourth aqueous metal bearing solution to form a partially metal depleted aqueous and a fourth partially loaded organic phase.

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24. The method of claim 23 wherein the extraction reagent is a mixture comprised of an aldoxime and a ketoxime.

25. The method of claim 24 wherein the mixture is further comprised of
10 an equilibrium modifier.

26. The method of claim 23 wherein the extraction reagent is an aldoxime.

15 27. The method of claim 23 wherein the extraction reagent is a ketoxime.

28. The method of claim 23 wherein the metal is zinc.

29. The method of claim 23 wherein the metal is uranium.

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30. The method of claim 23 wherein the metal is cobalt.

31. The method of claim 23 wherein the metal is molybdenum.

25 32. The method of claim 23 wherein the metal is nickel.

33. The method of claim 23 wherein the metal is copper.

34. The method of claim 28 wherein the extraction reagent is di-2-ethylhexylphosphoric acid.

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35. The method of claim 29 wherein the extraction reagent is a tertiary fatty amine.

36. The method of claim 30 wherein the extraction reagent is a tertiary
10 fatty amine.

37. The method of claim 31 wherein the extraction reagent is a tertiary fatty amine.

15 38. The method of claim 32 wherein the extraction reagent is an organo phosphonic acid or phosphinic acid or a carboxylic acid.

39. The method of claim 33 wherein the extraction reagent is an aldoxime, a ketoxime or a combination thereof.

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40. A method for extracting and recovering a copper from an aqueous solution containing the copper comprising of the steps of: (1) contacting an organic phase comprised of a water insoluble and water immiscible solvent solution of an extraction reagent formulation substantially free of copper

25 values with a first aqueous copper bearing solution to extract at least a

portion of the copper into the organic phase to form a copper depleted aqueous raffinate solution and a first partially loaded organic phase wherein the first aqueous copper bearing solution is the raffinate from step (3); (2) contacting the first partially loaded organic phase with a second aqueous copper bearing solution to form a copper depleted aqueous raffinate solution and a second partially loaded organic phase having a copper content greater than the first partially loaded organic phase; (3) contacting the second partially loaded organic phase with a third aqueous copper bearing solution to form a copper depleted aqueous raffinate solution and a third partially loaded organic phase having a copper content greater than the second partially loaded organic phase; (4) contacting the third partially loaded organic phase with a fourth aqueous copper bearing solution to form a partially copper depleted aqueous and a fourth partially loaded organic phase.

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41. The method of claim 40 wherein the extraction reagent is an aldoxime, a ketoxime or a combination thereof.

42. The method of claim 41 wherein the mixture is further comprised of an equilibrium modifier.

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43. The method of claim 40 further comprising the step of recovering the copper by contacting the fourth partially loaded organic phase with an aqueous acid solution wherein the copper is transferred to the aqueous acid solution to form a strip aqueous phase.

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44. The method of claim 43 further comprising the step of recovering the copper from the strip aqueous phase by electrowinning.